

REMARKS

This response is being presented in response to the Office Action of June 21, 2004. The Examiner has indicated that all of the claims, that is claims 1-22 and 34-44, have been rejected. In light of the amendments and following detailed arguments, it is respectfully submitted that the claims fully distinguish over the applied prior art and are in condition for allowance.

The Examiner rejected claims 1-4, 8, 10-14, 18, 34, 38-40, 42 and 44 under 35 USC §103 as being unpatentable over Proscia (US 5,286,520) in view of Tracy et al (US 4,687,560) and Florczak (US 6,268,019). Claims 1, 2, 4-9, 17-22, 34-37 and 40-44 were rejected under 35 USC §103 as being unpatentable over Gallego et al (US 6,048,621) in view of Tracy et al and Florczak. Claims 1, 2, 5-8, 10-16, 18, 23, 34-35, 38-42 and 44 were rejected under 35 USC §103 as being unpatentable over Riaz et al (US 5,385,751) in view of Tracy et al and Florczak. Claims 1, 2, 8, 10-14, 17, 19, 34, 38-40 and 42 are rejected under 35 USC §103 as being unpatentable over Florczak in view of Proscia or vice versa.

The present invention provides a chemical vapor deposition process for the production of a tungsten oxide coating which uses particular tungsten precursors and which is carried out in a temperature range (500°-720°) than was previously contemplated. This allows coatings to be deposited within a range of stoichiometries. The higher temperatures of the range offer advantages in the on-line production of coated glass, as there is an improved opportunity to deposit an additional coating or coatings on-line. The independent claims of the present invention have been amended to clarify that the deposition processes occur in an on-line process. Support for this amendment can be found, at least, on page 2, lines 13-18 of the application as filed.

Independent claim 1 was rejected: under 35 USC §103 as being unpatentable over Proscia in view of Tracy and Florczak; under 35 USC §103 as being unpatentable over Gallego in view of Tracy and Florczak; and under 35 USC §103 as being unpatentable over Florczak in view of Proscia or vice versa.

Independent claim 1 is directed to a chemical vapor deposition process for depositing a coating comprising tungsten oxide on-line on the surface of a glass substrate to produce a solar control glass which transmits a high percentage of incident light. The process directs a gaseous stream comprising tungsten oxyhalide or tungsten chloride and a source of oxygen on to the surface of the glass substrate. The glass substrate is at a temperature in the range 500°C to 720°C.

Independent claim 20 was rejected under 35 USC §103 as being unpatentable over Gallego in view of Tracy and Florczak. Claim 20 is directed to a chemical vapor deposition process for coating glass. The process comprises directing a gaseous stream containing a tungsten compound and a source of oxygen on to the surface of a glass substrate thereby forming a non-stoichiometric tungsten oxide layer. The tungsten oxide layer is overcoated with a further layer.

Independent claim 38 was rejected under: 35 USC §103 as being unpatentable over Proscia in view of Tracy and Florczak; 35 USC §103 as being unpatentable over Riaz in view of Tracy and Florczak; and 35 USC §103 as being unpatentable over Florczak in view of Proscia or vice versa. Independent claim 38 defines a chemical vapor deposition process for coating glass. The process includes entraining a tungsten compound in a gas by flowing the gas over a tungsten compound at a temperature below its melting point. The gaseous stream is directed onto the surface of a glass substrate thereby forming a tungsten oxide layer. The glass substrate is at a temperature in the range of 500°C to 720°C.

Independent claim 40 was rejected: under 35 USC §103 as being unpatentable over Proscia in view of Tracy and Florczak; under 35 USC §103 as being unpatentable over Gallego in view of Tracy and Florczak; under 35 USC §103 as being unpatentable over Riaz in view of Tracy and Florczak; and under 35 USC §103 as being unpatentable over Florczak in view of Proscia or vice versa.

Independent claim 40 defines a method of coating glass, which comprises providing a glass substrate in a chemical vapor deposition process having a temperature in the range of 500°C to 720°C. Then, preparing a gaseous stream comprising a source of oxygen and a

tungsten compound selected from the group consisting essentially of tungsten oxyhalide and tungsten chloride. And finally, directing the gaseous stream on to the glass substrate, thereby depositing a coating comprising tungsten oxide on the glass substrate

Independent claim 41 was rejected: under 35 USC §103 as being unpatentable over Gallego in view of Tracy and Florczak; and under 35 USC §103 as being unpatentable over Riaz in view of Tracy and Florczak.

Claim 41 defines a chemical vapor deposition process for depositing a coating comprising tungsten oxide on the surface of a glass substrate. A gaseous stream comprising tungsten oxyhalide or tungsten chloride and an ester are directed on to the surface of the glass substrate.

The independent claims have been amended to further clarify that the process occurs on-line, i.e. that the coating is applied to the glass substrate in an on-line process.

Rejection of claims 1-4, 8, 10-14, 18, 23, 34, 38-40, 42 and 44 under 35 USC §103 as being unpatentable over Proscia (US 5,286,520) in view of Tracy et al (US 4,687,560) and Florczak (US 6,268,019).

The claim as now amended is directed to a CVD process, which is carried out during an on-line float glass production process. Proscia discloses on-line CVD processes which are carried out at atmospheric pressure during the float glass production process. Proscia fails to teach the use of tungsten chloride or an oxyhalide as the tungsten precursor, and thus the Examiner relies on the disclosure of Tracy to show these precursors.

As previously submitted, Tracey discloses *plasma assisted* chemical vapor deposition processes. Thus at column 4 line 3 Tracey states that "The combination of the reaction chamber pressure and the vapor pressure of the gases inserted into the chamber establish a system pressure substantially less than atmospheric pressure. A *plasma reaction* is induced within the chamber and among the reactants". It is clear that the on-line CVD processes of this invention, which are carried out at atmospheric pressure, are distinguished from *plasma assisted CVD processes* such as those described by Tracey which are carried out at substantially lower temperatures.

One skilled in the art of chemical vapor deposition processes would not look to the plasma assisted CVD (PACVD) process of Tracy in combination with an atmospheric pressure

CVD process as shown in Proscia and in the present invention. PACVD processes are carried out at much lower pressures than the atmospheric pressure CVD process of the present invention.

One skilled in the art would have no motivation to consider the PACVD process in an on-line process wherein the hot glass ribbon is at a temperature between about 500-720 °C.

Further, one skilled in the art would not anticipate that a precursor useful in a PACVD process would also be useful in an atmospheric pressure CVD process. In an atmospheric pressure CVD process the reactants are vaporized and conveyed to the surface of the hot glass ribbon where the reaction energy is provided by the heat of the glass ribbon. Thus the reaction is dependent upon the energy in the form of heat found in the glass ribbon. PACVD occurs when an electrical discharge in a low pressure mixture of volatile reactants causes the formation of a variety of highly energetic species, e.g. atoms metastables, radical ions and the like which chemically interact to form stable deposits. One skilled in the art would not expect a reactant which works in a PACVD process to work in an atmospheric pressure CVD process. The processes are very different and the use of various reactants could not be projected from one process to the other.

Further distinguishing atmospheric pressure CVD processes from PACVD processes, PACVD processes are designed, as disclosed by Tracy, to operate at lower temperatures and to provide “higher” deposition rates. Tracy’s processes are operated at ambient temperature and provide what is described as an enhanced rate of deposition. However, it should be noted that example 1 of Tracy shows an “enhanced” deposition rate of 2000Å over 7 minutes, i.e. about 285Å/minute. This “enhanced” rate of deposition is far lower than that required by atmospheric pressure CVD, which, as suggested by Florczak (column 7, line 8) provides a deposition rate of 1000Å/sec. Similarly, the present application notes depositions far in excess of that expected by PACVD, as shown in table 2.

From the above, a person skilled in the relevant art would know that at the time of the invention, PACVD would not be used to coat a glass ribbon produced in an on-line float glass process. Attachment A to this amendment is an illustration from the text “Large Area Glass Coatings” which describes the state of PACVD at the time of the writing (January 2000). On

page 171 it is noted that "PACVD does not yet play a large role among the float glass processes used on a commercial scale. Today, only thin film amorphous silicon solar cells are made by this process." Page 173 of this text further notes that "[i]t is therefore only fair to say that PACVD is presently only in the initial stage of development."

The Examiner utilizes the teachings of Florczak in order to prove that one would have a reasonable expectation of success in adopting the precursors of Tracy for use in the processes of Proscia. However, it is respectfully submitted that Florczak specifically indicates that the defined invention relates to atmospheric pressure CVD processes (column 1, line 12). Florczak also notes in column 1, line 21 that in order to be economical the coatings must be deposited at rates which are commensurate with the operating speeds of commercial float lines. It is even acknowledged that low pressure CVD processes are batch operations (no on-line) and produce film at low deposition rates. All of these things teach away from the use of Florczak to show that precursors of PACVD processes are interchangeable with precursors of atmospheric pressure CVD processes. Thus, it is respectfully submitted that combining the atmospheric pressure CVD process of Proscia with the PACVD process of Tracy in view of the teachings of Florczak is improper, and this rejection should be withdrawn.

In view of the above, one skilled in the art would not regard Tracey as relevant to Applicant's invention as presently claimed. There is nothing in the secondary references which would suggest that Tracey's precursor would be useful in an on-line process.

In addition, the Examiner combines Tracy and Florczak to indicate that it was obvious to use tungsten chloride or tungsten oxytetrachloride in a CVD process for the deposition of tungsten oxide. Applicant again asserts that the Tracy reference is not applicable to the present invention because it teaches a different process, not one that a person skilled in the art would look to when designing a CVD process. With regard to Florczak, while this reference teaches a CVD method, nothing in this reference is relevant to the *deposition of tungsten oxide*. Florczak primarily addresses the deposition of titania using the reactor described in Figure 1 of the reference. Only in the abstract, and at column 6, line 55, does Florczak suggest the use of the process with any other metals. Even here, the only other suggested metals are tin germanium and

vanadium. There is *nothing to suggest to one skilled in the art that the processes of Florczak would be compatible with metals outside this group, and certainly not to tungsten*. As there is no suggestion in Tracy to use a chemical vapor deposition process, and no suggestion in Florczak that the process described therein would be compatible with any metals not listed, i.e. tungsten, there is nothing in either reference to lead one skilled in the art to combine those references. Therefore, it is respectfully submitted that the combination of these references is improper.

It is also respectfully submitted that even if these references could be combined, they would not yield an on line process as is presently claimed. The plasma assisted CVD process of Tracy do not yield deposition rates that are acceptable in the on-line process of the present invention. Combining Tracy with the other references would necessarily yield a process which would not be suitable for on-line processes, but which would instead be limited to batch processes. Therefore, even if these references could be combined, as suggested by the Examiner, they would not yield the claimed processes.

In view of the above, it is respectfully submitted that the rejections of claims 1-4, 8, 10-14, 18, 23, 34, 38-40, 42 and 44 under 35 USC §103 as being unpatentable over Proscia (US 5,286,520) in view of Tracy et al (US 4,687,560) and Florczak (US 6,268,019) is improper and should be withdrawn.

Rejection of claims 1, 2, 4-9, 17-22, 34-37 and 40-44 under 35 USC §103 as being unpatentable over Gallego et al (US 6,048,621) in view of Tracy et al and Florczak.

As with the preceding rejection the Examiner acknowledges that Gallego does not teach the use of Tungsten oxyhalides or tungsten chlorides as required by the claims of the present invention. As with the preceding rejection, the Examiner relies on the disclosures of Tracy and Florczak to overcome these deficiencies.

As before, applicant respectfully asserts that Tracy does not disclose a chemical vapor deposition process, as is used in the present invention, but instead teaches a plasma deposition process, which is significantly different, and would be so recognized by one skilled in the art. As stated above, the claims of the present invention have been amended to specify that the present invention utilizes a CVD process, a term that is well known in the art. Tracy, as demonstrated

above, thus teaches that the reactants tungsten chloride and tungsten oxytetrachloride are useful in deposition processes carried out under vacuum, at low temperature and which use electrical energy to drive plasma formation. These processes are different from, and in fact are irrelevant to the chemical vapor deposition processes of the present invention, which are carried out at atmospheric pressure and high temperature, and which use heat to drive the reaction and not electrical energy. Thus, one skilled in the art would not look to the Tracy reference as being relevant to the present invention. Therefore, the use of the Tracy reference against the present invention is improper.

Also, the use of Tracy and Florczak together suffers from the same deficiencies asserted above. The Tracy reference is not applicable to the present invention because it teaches a different process, not one that a person skilled in the art would look to when designing a CVD process. With regard to Florczak, while this reference teaches a CVD method, nothing in this reference is relevant to the *deposition of tungsten oxide*. Florczak primarily addresses the deposition of titania using the reactor described in Figure 1 of the reference. Only in the abstract, and at column 6, line 55, does Florczak suggest the use of the process with any other metals. Even here, the only other suggested metals are tin germanium and vanadium. There is *nothing to suggest to one skilled in the art that the processes of Florczak would be compatible with metals outside this group, and certainly not to tungsten*. As there is no suggestion in Tracy to use a chemical vapor deposition process, and no suggestion in Florczak that the process described therein would be compatible with any metals not listed, i.e. tungsten, there is nothing in either reference to lead one skilled in the art to combine those references. Therefore, it is respectfully submitted that the combination of these references is improper.

Therefore, it is asserted that the rejection of claims 1, 2, 4-9, 17-22, 34-37 and 40-44 under 35 USC §103 as being unpatentable over Gallego et al (US 6,048,621) in view of Tracy et al and Florczak is improper, and should be withdrawn.

Rejection of claims 1, 2, 5-8, 10-16, 18, 23, 34-35, 38-42 and 44 under 35 USC §103 as being unpatentable over Riaz et al (US 5,385,751) in view of Tracy et al and Florczak.

With regard to the Riaz reference, the Examiner acknowledged that Riaz does not explicitly teach the use of applicant's tungsten precursor. Applicants assert that Riaz specifically teaches the use of a tungsten alkoxide precursor in a CVD process. Riaz does not explicitly or implicitly, suggest any other tungsten containing precursor. Thus, it is respectfully submitted that the disclosure of Riaz is no broader than the disclosure of the Gallego reference. Therefore, the same assertions made with regard to Gallego are also applicable against the rejection based on Riaz.

As before, applicant respectfully asserts that Tracy does not disclose a chemical vapor deposition process, as is claimed in the amended independent claims, but instead teaches a plasma deposition process, which is significantly different, and would be so recognized by one skilled in the art. Tracy, as demonstrated above, thus teaches that the reactants tungsten chloride and tungsten oxytetrachloride are useful in deposition processes carried out under vacuum, at low temperature and which use electrical energy to drive plasma formation. These processes are different from, and in fact are irrelevant to the chemical vapor deposition processes of the present invention, which are carried out at atmospheric pressure and high temperature, and which use heat to drive the reaction and not electrical energy. Thus, one skilled in the art would not look to the Tracy reference as being relevant to the present invention. Therefore, the use of the Tracy reference against the present invention is improper.

Also, the use of Tracy and Florczak together suffers from the same deficiencies asserted above. The Tracy reference is not applicable to the present invention because it teaches a different process, not one that a person skilled in the art would look to when designing a CVD process. With regard to Florczak, while this reference teaches a CVD method, nothing in this reference is relevant to the *deposition of tungsten oxide*. Florczak primarily addresses the deposition of titania using the reactor described in Figure 1 of the reference. Only in the abstract, and at column 6, line 55, does Florczak suggest the use of the process with any other metals. Even here, the only other suggested metals are tin germanium and vanadium. There is *nothing to suggest to one skilled in the art that the processes of Florczak would be compatible with metals outside this group, and certainly not to tungsten*. As there is no suggestion in Tracy to use a

chemical vapor deposition process, and no suggestion in Florczak that the process described therein would be compatible with any metals not listed, i.e. tungsten, there is nothing in either reference to lead one skilled in the art to combine those references. Therefore, it is respectfully submitted that the combination of these references is improper.

In view of the above, the Rejection of claims 1, 2, 5-8, 10-16, 18, 23, 34-35, 38-42 and 44 under 35 USC §103 as being unpatentable over Riaz et al (US 5,385,751) in view of Tracy et al and Florczak is submitted to be improper, and it is respectfully requested that this rejection be withdrawn.

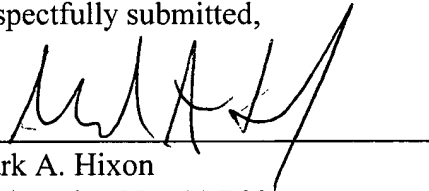
Rejection of claims 1, 2, 8, 10-14, 17, 19, 34, 38-40 and 42 under 35 USC §103 as being unpatentable over Florczak in view of Proscia or vice versa.

Proscia does not teach the precursors claimed herein. Florczak teaches an APCVD process for the deposition of fluorine modified titanium oxide films onto hot glass by using titanium tetrachloride vapors and suggests other metal halides as precursors. Florczak specifically mentions titanium, vanadium, tin and germanium, but *fails to discuss the possibility of tungsten as a precursor*. Vanadium and titanium are adjacent materials on the periodic table, and tin is known to have similar chemistry to titanium as is germanium, which lies on the periodic table in group IVB along with tin. Thus, one skilled in the art would recognize that Florczak is teaching that the metal chlorides of these related materials could be used in the process. However, one skilled in the art would not have reason to expect that unrelated metal chlorides with unrelated chemistries would successfully be used in the same process. There is no teaching in Florczak to suggest such an assumption and instead Florczak only suggests the use of related compounds. In particular, materials on the second and third transition metal series, such as tungsten, would not be expected to form chlorides which would be useful in the processes of Florczak. Only with hindsight analysis would one expect tungsten to be a useable material in the process of Florczak. Thus, no reasonable combination of the applied references renders unpatentable the invention claimed in claims 1, 2, 8, 10-14, 17, 19, 34, 38-40 and 42, and withdrawal of this rejection is respectfully requested.

Therefore, on the basis of the forgoing arguments, it is respectfully submitted that independent claims 1, 20, 38, 40 and 41 fully distinguish over the applied references. Any dependent claims not specifically discussed hereinabove are believed to be allowable based, at least, upon their dependence on allowable base claims as discussed above.

In view of the above remarks, a favorable reconsideration of the present application and the passing of this application to issue with all claims allowed are courteously solicited. If the Examiner wishes to modify any of the language of the claims in an effort to move the application towards allowance, a telephone call to the undersigned would be greatly appreciated.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'Mark A. Hixon', is written over a horizontal line. The signature is stylized with a large 'M' and 'H'.

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